ZX-81 ESF/81 MONITOR PROGRAM

Written By Tom Wheeler
(C) 1982

ESF/81 MONITOR: TABLE OF CONTENTS

SECTION	CONTENTS	PAGE
I	General Operation; Loading in the monitor	1
II	'Display Memory' Commands	2
III	'Alter Memory' Commands	4
IV	'Execute and Debug' Commands	5
V	'Saving' Programs	6
VI	'Loading' Programs	7
VII	Preserving Screen Contents	7

Entire contents copyright (c) 1982 by Tom Wheeler. Reproduction, in part or whole, by any means, is forbidden unless written permission or agreement is obtained from the author.

Any comments or suggestions regarding this program are invited. Write or call the author of the software...

Tom Wheeler
3604 Northern BLVD
Independence, MO 64052
(816) 358-7089

I. LOADING THE ESF/81 MONITOR PROGRAM FROM WAFER

Your ESF/81 monitor program will allow you to program your Sinclair ZX81 at the most elementary level, in "machine language."

In addition, the ESF/81 monitor will let you back up other machine-language programs stored on ESF wafers for extra security. Please note that although having several backup copies of important programs takes some of the worry out of computing, the copy capability of the ESF/81 monitor is not intended to aid in "bootlegging" software, and should not be used for this purpose. Illegal duplication of software hurts everyone, since it reduces the incentive to write more good software!

Loading of the ESF/81 monitor is exactly the same as for any other program stored on ESF wafers. First, get into menu mode:

PRINT USR 1Ø24Ø (New LINE)

Select option 1, "LOAD", and file number 1 (Be sure to place the ESF/81 monitor wafer into the drive!). The drive will start up as usual, and ESF/81 will automaticly start once loading is complete. The screen will show something like:

```
ZX81 MONITOR PROGRAM
COPYRIGHT 1982 TOM WHEELER
COMMAND?
```

NOTE: For safety, it is suggested that you make a backup copy of your ESF/81 monitor program. To do this, skim over sections I through IV; then follow the backup procedure in section V.

II. GENERAL OPERATION, DISPLAYING MEMORY: 'D' , 'A' , 'G'

The ESF/81 monitor operates at a lower level than the BASIC interpreter in your ZX81. Therefore, the commands are much simpler in form, but the monitor has the final say in determining right and wrong. You'll find that the ESF/81 monitor simply cannot respond to an incorrect keystroke -- it will ignore anything that is not "logical." If you are not aware of this, it may seem that the ESF/81 has "locked up" or lost control, but this is rarely ever the case.

The format in which the ESF/81 can accept commands is:

COMMAND KEY DATA BYTES (the number of bytes entered depends upon the command)

Each command is a single key stroke, and the data or addresses needed always follow. The NEW LINE key is not used, as the ESF/81 monitor automaticly takes action when the information has all been entered correctly.

There is no "backspace" function,if you should make a mistake. (This conserves memory). You can escape any command (before it has been completed, of course) by typing in an 'X'. The monitor will immediately respond with another COMMAND? prompt, indicating abortion of the previous sequence.

The contents of memory are displayed in three different forms with the display-memory commands 'D', 'A', and 'G'. All three display-memory commands need a four-digit hexadecimal number to be entered for completion. If necessary, add leading zeros to the number in cases like "ØØFE."

D - This prints the hexadecimal value of the contents of the specified address, and beyond.

A typical use of the 'D' command would be looking at the 8K BASIC ROM:

```
DØØØØ
ØØØØ  D3 FD Ø1 FF 7F C3 CB Ø3
ØØØ8  2A 16 4Ø 22 18 4Ø 18 46
:
MORE? Y OR N
```

After the screen has filled, ESF/81 will display the message 'MORE? Y OR N' . Typing'Y' will cause the computer to resume the "memory dump." Typing 'N' will return you to the command level of the monitor.

A - This command takes the byte out of each specified address, and converts it from true ASCII to Sinclair's ZX character codes, then prints the actual character. This command is useful when searching for "strings" in memory. The format is the same as the 'D' command.

```
A7D5Ø
7D5Ø  XNO BREA
7D58  KS IN RO
7D6Ø  MXGXBREA
```

G - This command is exactly like the 'A' command, except that the characters are printed as ZX character codes (no conversion from ASCII to ZX is attempted.) Text created on the ZX81 (e.g., BASIC programs) will be visible when using this command.

III ALTER MEMORY COMMANDS

Two commands are in this group. The 'E' command is used to 'edit' memory byte-by-byte. The 'M' command performs a block move of one area in memory to another.

The 'E' command format is:
E address , where 'address' is a four-character hex code.

To edit some bytes in the free-RAM space of the computer, the following sequence might be used:

```
E45ØØ
45ØØ Ø2 CD
45Ø1 Ø2 23      (The underlined portions are typed by the operator)
45Ø2 Ø2 ØF
45Ø3 Ø2 C9
45Ø4 Ø2 X       (Hit the 'X' key to escape)
COMMAND?
```

NOTE: During the memory edit operation, the screen will fill with characters entered during the session. When the screen becomes full (left-hand column), a scroll does NOT occur. Instead, the screen clears with the cursor in the upper left hand corner. The screen clearing will usually occur immediately AFTER entering hex bytes at the bottom of the screen. This is perfectly normal, so don't let it alarm you -- ESF/81 is still in full control.

The 'M' command moves a complete "block" of data from one set of memory addresses to another. For example, the command:

```
MØØØØ Ø455 46ØØ
```

Will move the data in addresses ØØØØ to Ø455 as a 'block' with a destination address of 46ØØ.

In this case, part of the 8K BASIC interpreter ROM is actually being copied out into RAM memory.

REMEMBER: During any command, if you should make a mistake and wish to abort before typing in the last character, simply press the X key to get back to the COMMAND? prompt.

Two commands, 'J' and 'B' allow you to manually branch to your own machine language programs in RAM or ROM, and set 'breakpoints' in the programs if they reside in RAM.

The 'J' command is used for JUMPING to a desired routine. The command JØ46F will return control to Sinclair BASIC.

The J command is not performing an actual JUMP instruction, however; 'J' treats the object address as a subroutine, so that control will be returned to the monitor program if a RET instruction is executed. One nice feature of the ESF/81 monitor is that it does print the contents of all the registers whenever control has been returned to the monitor by a CALLed program.

The 'B' command can be used to set a breakpoint in RAM. When program execution reaches the break, control is transferred to the ESF/81 monitor, and the contents of all registers prior to hitting the break are printed. (The actual contents of the registers are not preserved by ESF/81).

How does the ESF/81 set a breakpoint? It does so by inserting a three-byte CALL instruction into the part of the code specified in the B command. Therefore breakpoints should not be placed at RET or JR instructions, or strange things may happen to the code following the breaks!

Forget where you placed a breakpoint? Just type in BØØØØ. If there is a breakpoint set, you'll see a warning message with the break address in it. Otherwise, you'll see:

NO BREAKS IN ROM

Remember, it is not possible to write data into a ROM; so breakpoints cannot be set there.

V SAVING MACHINE LANGUAGE PROGRAMS ON ESF WAFERS

The 'S' command provides a means of storing your machine language programs on ESF wafers. The format is exactly like ESF's machine-file format; programs saved with the ESF/81 monitor can be directly loaded from Menu Mode, or "chained" from BASIC programs using the procedure described in your ZX81 ESF owner's manual.

The format for saving a program is:

S aaaa bbbb cccc , where:

'aaaa' is the starting address of the memory block to be saved.

'bbbb' is the length of the program.

'cccc' is the "autostart" or transfer address of the program. If 'cccc' is equal to 28ØØH , control is returned to the menu.

After entering these parameters, the system will ask:

ESF FILE NUMBER?

Type a number from 1 to F (15) to specify the file number, and the program will be saved and verified. In case of error, the ESF ERROR CODE is returned. Here are the codes, and their meanings:

01 - Write-protected wafer.
04 - Tape too short.
08 - Parity error ; defedtive synchronization.
10 - Checksum error
20 - Out of memory
40 - Verify error
80 - EOF mark detected

Backup of ESF/81 monitor program:

(1) Load in the ESF/81 like normal, but leave ESF/81 wafer in slot.
(2) Type 'L'. Computer will ask, "ESF FILE NUMBER?". Answer with '1'.
(3) The ESF/81 will load in AGAIN, but this time ESF/81 will be in full control, and will print its own START, LENGTH, and AUTOSTART parameters on the screen.
(4) Place fresh wafer in drive slot.
(5) Use the 'S' command to re-copy the ESF/81 monitor: S START LENGTH AUST.

Loading machine-language programs from ESF wafers is accomplished with the 'L' command. There is only one parameter, the file number. The computer will ask for it after 'L' has been typed. To load in program file 3 from a wafer, one would type:

L
ESF FILE NUMBER?3

The computer will start the ESF drive and load in file 3. It will print some information about the file also-- its STARTING ADDRESS, LENGTH, and AUTOSTART. If you wish to execute the program, use the 'J' command to branch to the AUTOSTART. This information will also allow you to make backup copies of important programs -- but please note:

THE ESF/81 MONITOR WAS NOT WRITTEN TO AID IN THE ILLEGAL PRACTICE OF "BOOTLEGGING" SOFTWARE. PLEASE RESTRICT OPERATION TO BACKUPS ONLY WHEN USING THIS FEATURE.

If any error should occur during loading, the appropriate ESF ERROR CODE will be printed on the screen as described in section V.

VII PRESERVING THE SCREEN CONTENTS

If you have the CAI/P40 printer online in your ZX81 system, you can use the screen-dump capability of the printer firmware from the ESF/81 monitor. Simply depress the SHIFT key momentarily whenever the computer is awaiting keyboard input to dump the entire video display to the printer. To abort the printing of the screen, depress the BREAK key.

CAUTION: Since the design of the P/40 printer firmware is not fully known, it can not be predicted what effect a screen dump will have

upon the ESF/81 monitor's parameter storage area. It is not recommended that screen dumps be attempted when in the middle of entering parameters for the various ESF/81 commands. The results may be unpredictable.